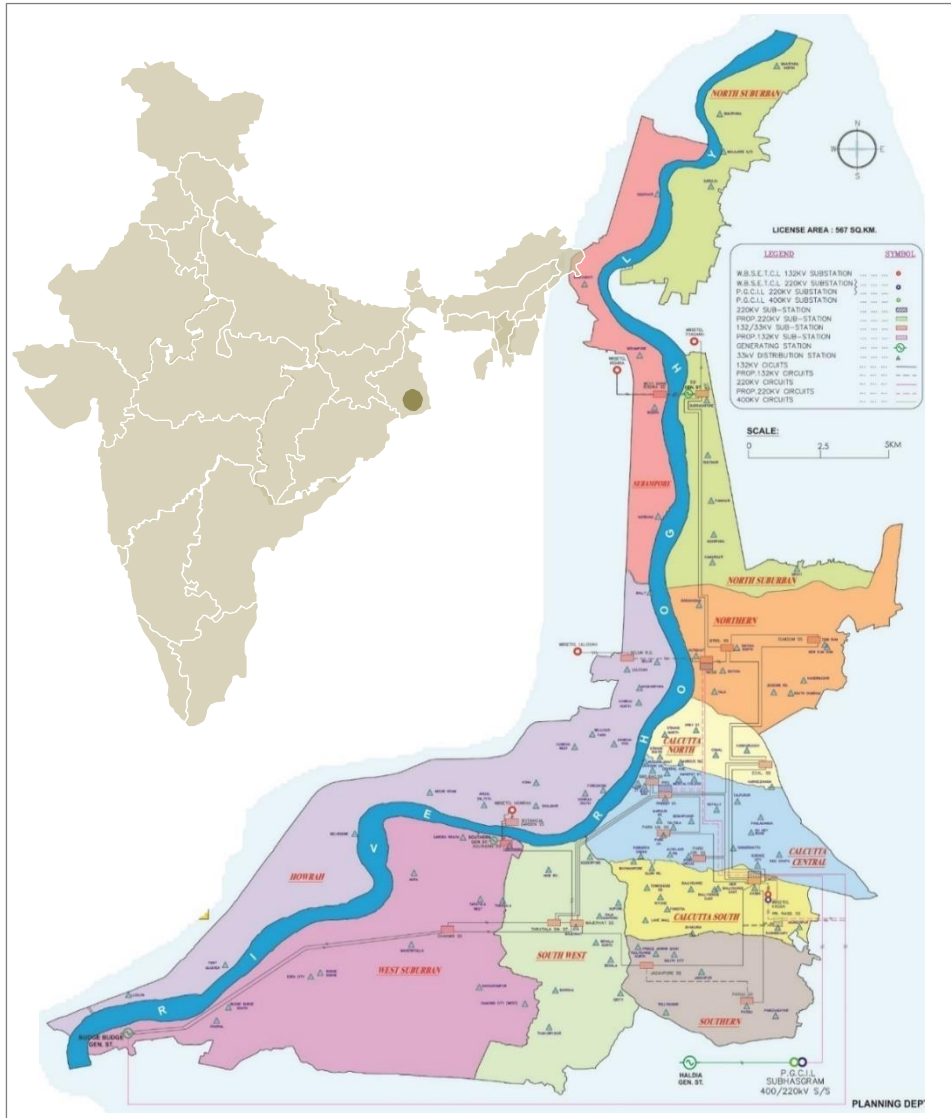




## POWER QUALITY – ISSUES AND MITIGATION

29<sup>TH</sup> November, 2017

# POWER DISTRIBUTION IN AND AROUND KOLKATA SINCE 1899



## KEY HIGHLIGHTS

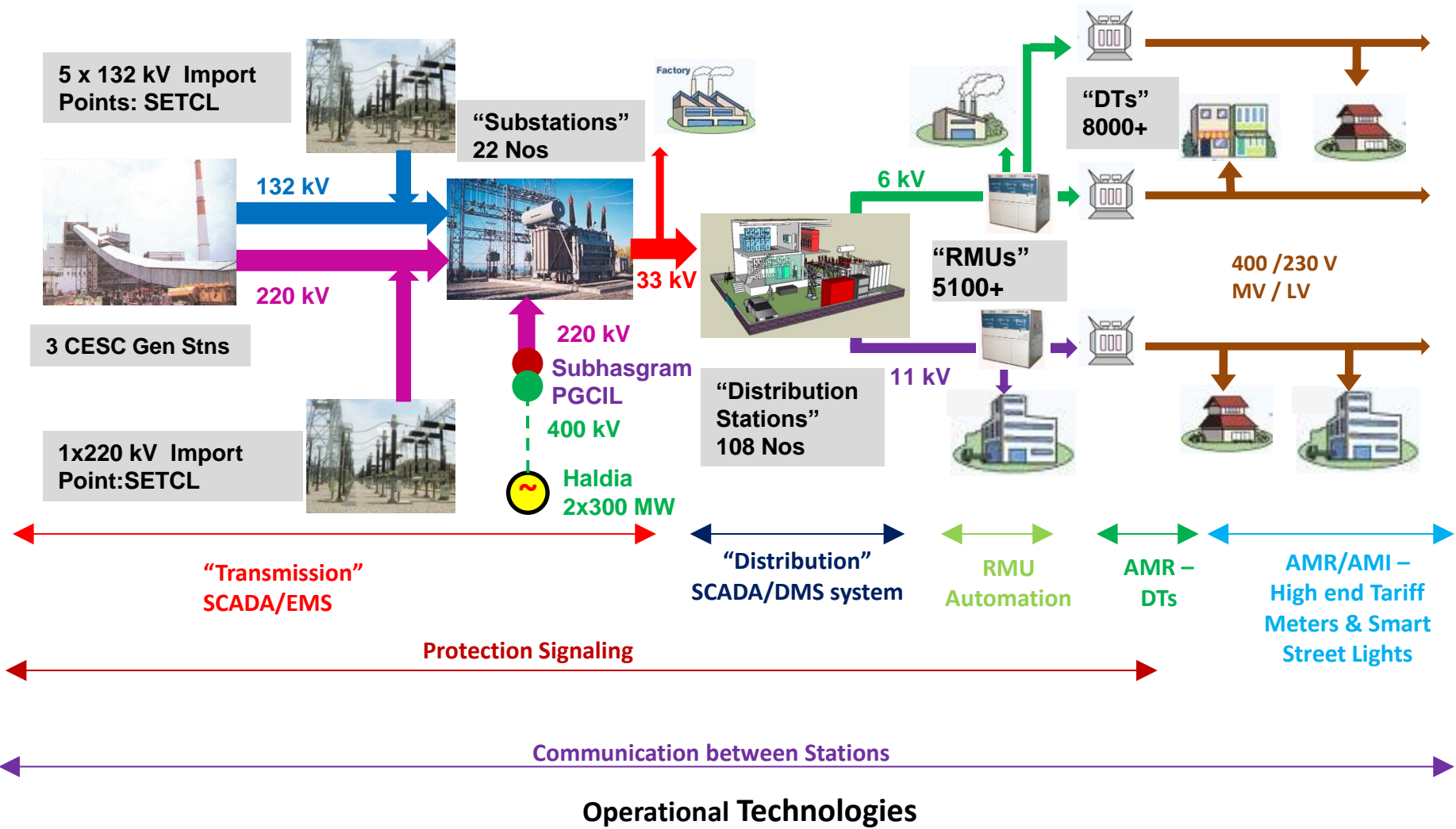
▶ Licensed area : 567 sq. KM

▶ Energy Sold : 9410 MU  
Peak Met: 2159 MW

▶ Generation Capacity:1125MW

▶ Consumers : ~31 lacs

▶ Dist. Franchisee: Kota, Bikaner & Bharatpur



SCADA

EMS

DMS

OMS

DCS

## Issues

Voltage excursion beyond permissible limits at all Voltage Levels

## Mitigation Measures

220, 132, 33 KV – All Power Transformers (220-132/33 KV and 132/33 KV) are provided with On-load Tap Changer with Remote Control facility

11 , 6 KV – All Power Transformers (33/11-6 KV) are provided with On-load Tap Changer with AVR

230 / 400 V – All Distribution Transformers (11-6 / 0.415 KV) provided with off-load Tap Control switch.

Capacitor Banks are provided on 132 , 33 , 11, 6 KV Voltage Levels. Automatic Power Factor Controllers provided on secondary side of Distribution Transformers.

During Winter lean periods, embedded generators are used to absorb Reactive Power thereby controlling Voltage rise.

Monitoring of DT Voltages through in-house developed Web Portal to identify real –time voltage excursions at LV side of DTs

Analytics to identify disproportionate loading of DTs

Issues	Mitigation Measures
Frequency Excursion beyond permissible limits	Islanding from Grid in case of frequency excursions beyond limits. Embedded generation stabilises frequency of supply to the consumers.
Low Power Factor Conditions	Power Factor correction capacitors installed at different voltage levels.
Unbalanced Loads in LV network and neutral loading	In-house developed monitoring dashboard enables monitoring of phase imbalances in DTs. Corrective actions taken for balancing loads in 3 phases.
Voltage dips due to faults in the network	Instantaneous unit protection used in all EHT and HT circuits upto Distribution Stations. Fault clearing time < 100 msecs. Faults in Distribution Station 6/11 KV outgoing feeders : < 300 msecs.  Transformer neutrals solidly earthed at 132 KV and 415 V systems. 33 KV System non-effectively earthed through earthing transformer. Transformer neutral Earthing < 1.0 ohm at 415 V; < 0.5 ohms at 132, 33 KV; <0.2 ohms at 220 KV and Generating Stations

## Issues

## Mitigation Measures

Voltage and Current  
Harmonics at different levels

Measurements are done periodically for Voltage and Current  
Harmonics. Voltage % THD < 3% , Current % THD < 10 %.

POWER QUALITY ANALYSIS															
Category	HT Industrial											HT Commercial	HT Domestic		CEA Limits
	Jute Mill				Steel & Rolling		Engineering & Workshop	Chemical	Tannery	Ordinance factory	Aluminium Factory	Shopping Mall	Hospital	Office	
Specific Consumer	Jagatdal Jute Mill	Caledonian Jute Mill	Budge Budge Jute Mill	Kamarhattya Jute Mill	British India Rolling Mill	Electro Steel Casting Ltd	Shalimer Wire & Industries	Hindustan Gas	Hindustan Tannery	Ichhapur Rifle Factory	Indal Co	South City	Woodlands	Writers Building	
Supply Voltage	3.3 KV	20 KV	6KV	6.6 KV	6.6 KV	33 KV	6.6 KV	6 KV	6.6 KV	33 KV	6.6 KV	11 KV	6.6 KV	6.6 KV	
<b>VOLTAGE DETAILS</b>															
A. THD-R%	0.59	1.63	1.71	1.91	1.7	0.8	2.94	1.34	0.82	0.75	1.92	2.52	2.28	1.97	
3rd HD	0.51	0.53	1.33	1.64	0.66	0.56	2.3	0.78	0.6	0.57	0.48	0.25	0.39	0.24	
5th HD	0.19	1.51	1.01	0.94	1.54	0.49	1.79	0.99	0.42	0.3	1.16	2.5	2.15	0.77	
7th HD	0.13	0.14	0.24	0.15	0.23	0.14	0.35	0.44	0.2	0.23	0.9	0.11	0.45	1.72	
9th HD	0.04	0.02	0.05	0.01	0.05	0.03	0.03	0.04	0.01	0.06	0.12	0.06	0.1	0.15	
B. Voltage Unbalance (%)	0.66	0.58	0.24	0.19	0.55	0.28	0.25	0.07	1.98	0.33	(-)	0.44	1.9	0.5	
C. Crest Factor	1.42	1.39	1.42	1.44	1.43	1.41	1.46	1.43	1.41	1.43	1.42	1.44	1.43	1.43	
<b>CURRENT DETAILS</b>															
A. THD-R%	1.52	8.15	2.88	3.27	3.95	6.97	7.88	1.74	2.36	6.19	7.27	5.91	12.71	5.47	
3rd HD	1.37	1.53	0	0.99	2.63	1.72	2.67	0.78	1.27	3.1	2.23	1.46	4.49	1.69	
5th HD	0.34	8.1	2.69	1.98	0	6.89	5.33	0.39	1.27	0	4.47	5.83	5.69	3.39	
7th HD	0.68	1	0.76	1.98	0	0.86	4	1.56	0	3.1	4.47	0.97	2.69	0	
9th HD	0	0	0	0.49	0	0	1.33	0	0	0	0	0	0.9	0	
B. Current Unbalance (%)	1.74	(-)	(-)	1.87	4.4	1.04	3.9	(-)	4	3.5	(-)	4.1	6.2	0.9	
C. Crest Factor	1.43	1.43	1.43	1.48	1.43	1.42	1.5	1.44	1.42	1.44	1.53	1.47	1.46	1.47	
D. Form factor	1.01	1.17	1.03	1.05	1.25	1.14	1.29	1.02	1.11	1.43	1.26	1.09	1.34	1.25	
<b>OTHERS</b>															
DPF	0.97	0.76	1	0.97	0.86	0.99	0.96	0.98	0.99	0.99	0.83	0.99	0.99	0.81	
VAR of 1 phase	48 lag	127 lag	1 lead	26 lag	10 lag	12 lag	12 lag	5 lead	10.05	2 lead	80 lag	16	34	20	

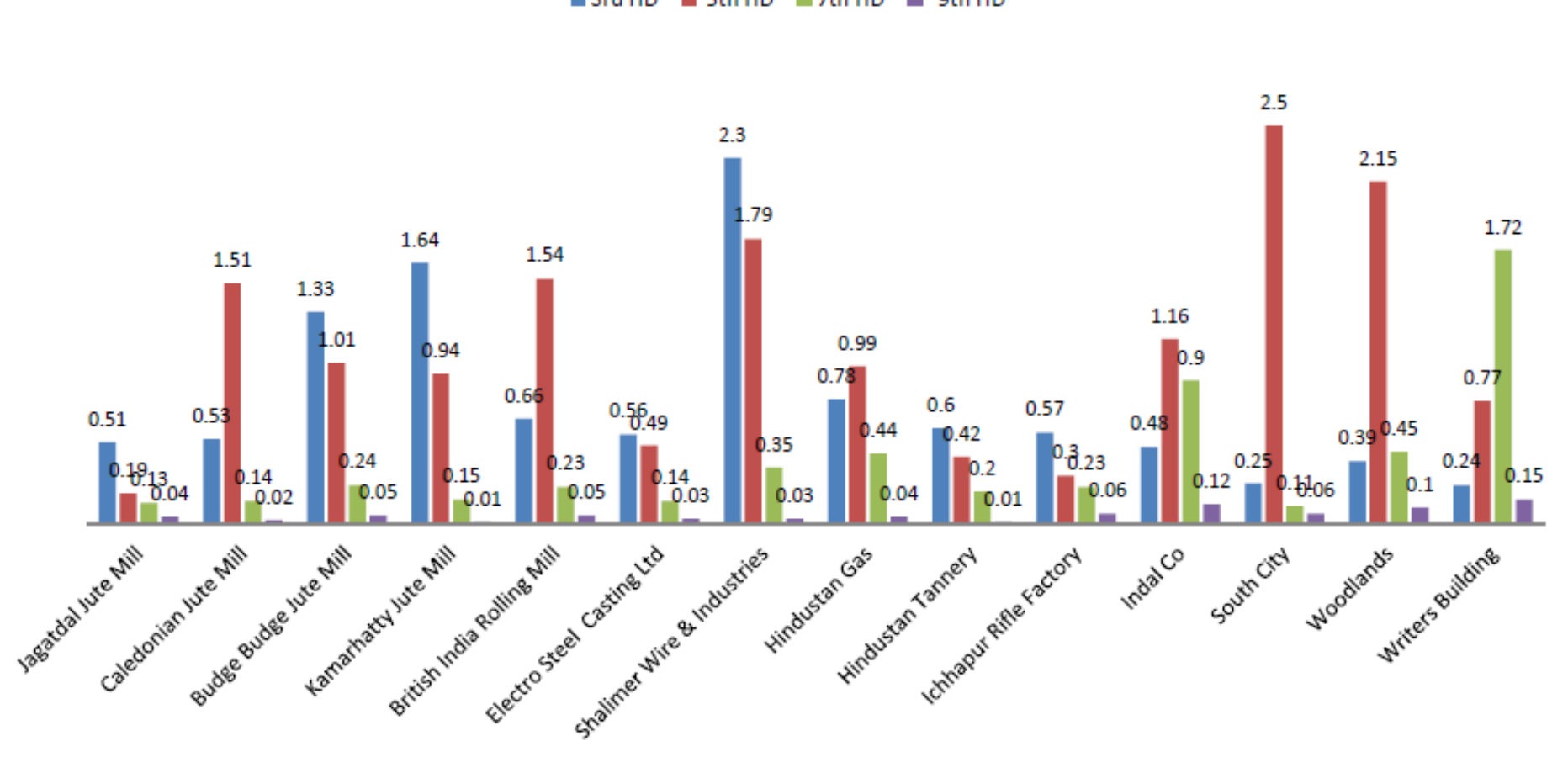
For 33 to 132 KV Voltage level,  
1. THD is 5% and Individual Harmonic of any Particular Frequency is 3%  
2. Maximum Permissible value of Voltage Unbalance is 3%

# Power Quality – Issues

## HT Consumer

### Harmonic Distortion in Voltage(%)

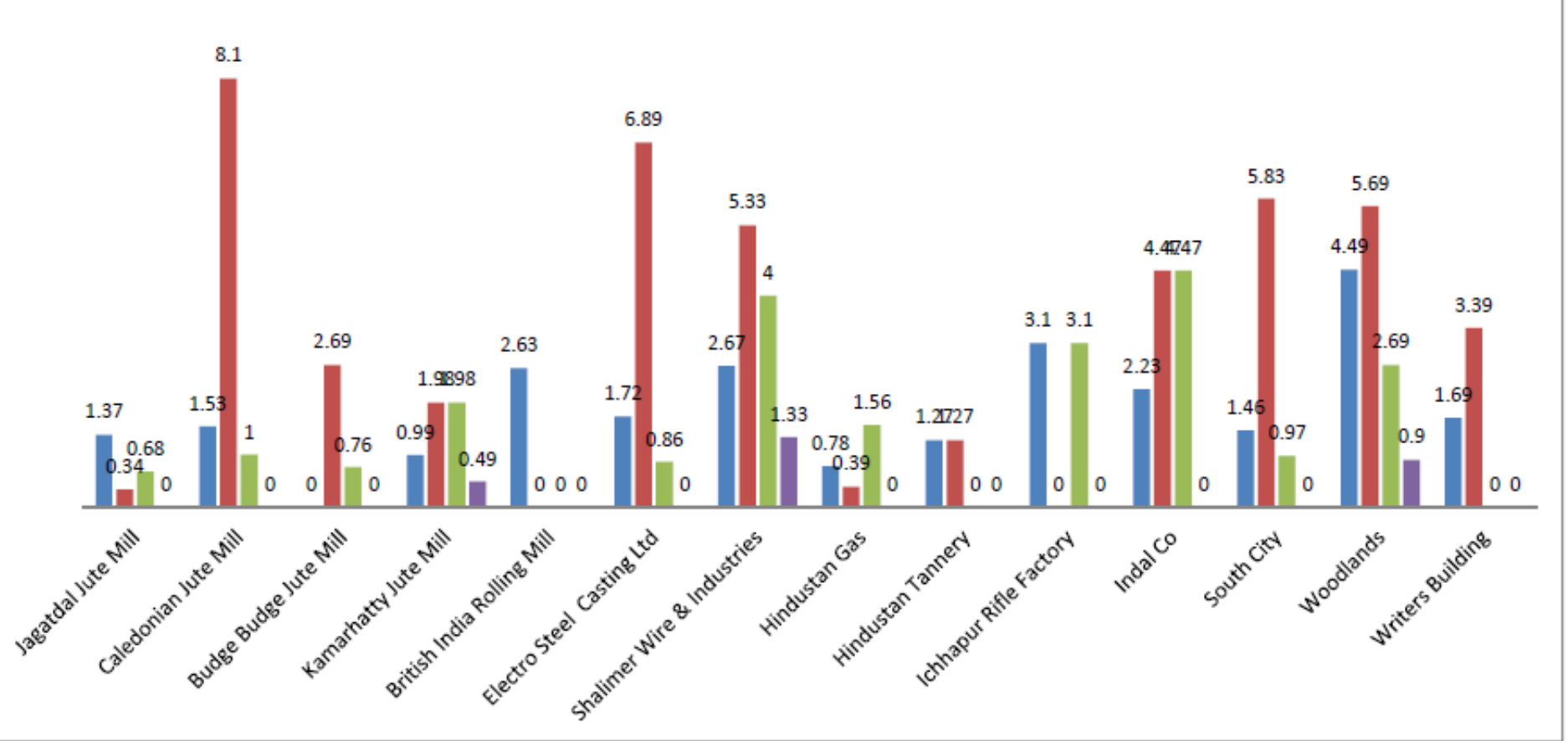
■ 3rd HD ■ 5th HD ■ 7th HD ■ 9th HD



# Power Quality – Issues

## Harmonic Distortion in Current(%)

■ 3rd HD ■ 5th HD ■ 7th HD ■ 9th HD





- ❑ Energy Efficient devices are found to generate high levels of Harmonic pollution, if not regulated by Standards.
- ❑ Solar PV invertors can also be a source of harmonic pollution.
- ❑ Higher levels of harmonics in the Distribution System may result in
  - ❖ Higher losses
  - ❖ Higher equipment loading and failures
  - ❖ Incorrect Energy metering

# Power Quality – Monitoring

Welcome to CESC Intranet | DTR DYNAMIC DATA

itweb:38772/tdamr/test\_acon\_sum\_f.jsp

RP- Sanjiv Goenka Group | CESC LIMITED

Metering Systems & Communication Control Center, Testing Department, 4 Sashi Sekhar Bose Row, Kolkata - 700025  
You Are Visitor No. 8371 and 0 user(s) are Visiting this Site Right Now

Click on a Block to see DTR Details

### DYNAMIC MONITORING OF DISTRIBUTION TRANSFORMERS

	SD	CSD	SWD	WSD	CCD	CND	ND	NSD	HD	SERD
Voltage-Current Abnormality	5	13	6	7	16	5	4	12	7	21
Over load	[Dark Grey]							4	[Dark Grey]	3
Unbalanced Load	[Dark Grey]	2	2	4	3	3	1	10	3	9
Low Power Factor	1	3	[Dark Grey]	5	3	4	1	4	10	9

0 10 20 30

Last Reading Within:  Hr(s)  
 Load Exceeding:  %  
 Unbalance Exceeding:  %  
 With Loading >=:  %  
 Avg PF <=:   
 With Loading >=:  %  
 Known Metering Defect:

Based on Last Reading Available from DTRs

SUBMIT

Browser: http://itweb:38772/tdamr/test\_acon\_sum\_f.jsp  
 Search...  
 DTR DYNAMIC DATA  
 File Edit View Favourites Tools Help

Metering Systems & Communication Control Center, Testing Department, 4 Sashi Sekhar Bose Row, Kolkata - 700025  
 You Are Visitor No. 8376 and 1 users are Visiting this Site Right Now

### DYNAMIC MONITORING OF DISTRIBUTION TRANSFORMERS

SD : Voltage-Current Abnormality (Hit Submit button to back to Grid View)

Rows: 3

SOURCE NAME	SOURCE CODE	DIST	VR	VB	VY	LR	LB	LY	AVG PF	LAST READING DATE TIME	KVA RATING	ABNORMALITY	PROBABLE INFERENCE
GARIA SOUTH T/H	<a href="#">0104810</a>	SD	6.813	242.13	240.52	95.4	153.3	147.5	.995	2017-11-28 11:15	315	Voltage-Current Abnormality	R-ph Voltage Missing Current Present (Met Defect ?)
BENI BANERJEE AVENUE O/T	<a href="#">0117200</a>	SD	2.594	240.72	2.979	82	66.5	84	-.996	2017-11-28 11:03	315	Voltage-Current Abnormality	R-ph Voltage Missing Current Present (Met Defect ?) Y-ph Voltage Missing Current Present (Met Defect ?)
K.M.NASKAR RD O/T	<a href="#">0117100</a>	SD	234.8	237.77	234.99	.1	.1	.1	.186	2017-11-28 11:03	315	Voltage-Current Abnormality	R-ph Current Missing (Feeder Fuse ?) Y-ph Current Missing (Feeder Fuse ?) B-ph Current Missing (Feeder Fuse ?)

Last Reading Within <input type="text" value="1"/> Hr(s)	Load Exceeding <input type="text" value="120"/> %	Unbalance Exceeding <input type="text" value="60"/> %	With Loading >= <input type="text" value="40"/> %	Avg PF <= <input type="text" value="0.6"/>	With Loading >= <input type="text" value="20"/> %	Known Metering Defect <input type="text" value="NO"/>	<b>SUBMIT</b>
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Based on Last Reading Available from DTRs

# Instant Voltage Read - HT Consumer

**Metering Department**

INSTANTENEOUS AMR DATA ON DEMAND

DTR READER | **HT CON READER** | LTCT CON READER

**HT-CONSUMER SNAPSHOT READER**

Please Enter at least Four Characters of you search criteria

Search By  Name  Meter No  Consumer No

CONSUMER NAME	METER NO	CONSUMER NO	Click 2 Read
SOUTH CITY SHOPPING MALL	4159507	0106400302	<a href="#">Read</a>
SOUTH CITY INTERNATIONAL SCHOOL 375A, PRINCE ANWAR SHAH ROAD	4143667	0106400303	<a href="#">Read</a>

**SOUTH CITY SHOPPING MALL**

Voltage 1	11.028 KV
Voltage 2	11.230 KV
Voltage 3	11.171 KV
Line Current 1	82.872 A
Line Current 2	87.784 A
Line Current 3	82.512 A
Instant KW Load	1621.770
Instant Overall PF	0.996 (+)
Meter No.	S4159507 [3P4W]
Reading Date-Time	28-11-2017 11:52:55

DTR READER | HT CON READER | LTCT CON READER

# Instant Voltage Read - LT Consumer

**Metering Department**

INSTANTENEOUS AMR DATA ON DEMAND

DTR READER | HT CON READER | LTCT CON READER

**LTCT-CONSUMER SNAPSHOT READER**

Please Enter at least Four Characters of you search criteria

Search By  Name  Meter No  Consumer No

CONSUMER NAME	METER NO	CONSUMER NO	Click 2 Read
KOLKATA WEIR INDUSTRIES	5117180	8502200100	<a href="#">Read</a>
M/S N G INDUSTRIES	5473696	8502500100	<a href="#">Read</a>
N G INDUSTRIES LTD.	3777927	8504401000	<a href="#">Read</a>
WEBSTAR INDUSTRIES PVT	3627968	8504901300	<a href="#">Read</a>
UNIPACK INDUSTRIES	3726667	8506200900	<a href="#">Read</a>
SUMAN INDUSTRIES	4582259	8506400801	<a href="#">Read</a>
VENUS PAINTS INDUSTRIES	3726553	8506502103	<a href="#">Read</a>
BAJAJ OIL INDUSTRIES	3777818	8506600500	<a href="#">Read</a>
SAMRAT INDUSTRIES	4159963	8506701501	<a href="#">Read</a>
JANATA RUBBER INDUSTRIES	2869241	8507100300	<a href="#">Read</a>

DTR READER | HT CON READER | LTCT CON READER

**VENUS PAINTS INDUSTRIES**

Voltage 1	235.200 V
Voltage 2	235.260 V
Voltage 3	233.640 V
Line Current 1	20.720 A
Line Current 2	18.200 A
Line Current 3	25.360 A
Instant KW Load	10.200
Instant Overall PF	0.703 (+)
Meter No.	S3726553 [3P4W]
Reading Date-Time	28-11-2017 11:56:25

# Instant Voltage Read - DTR

**Metering Department**

INSTANTENEOUS AMR DATA ON DEMAND

DTR READER
HT CON READER
LTCT CON READER

**DTR SNAPSHOT READER**

Please Enter at least Four Characters of you search criteria

Search By
 Name
 Meter No
 Source Code

Search

SOURCE NAME	METER NO	SOURCE CODE	Click 2 Read
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
PRESIDENCY COLLEGE P/T	5076262	0336800	<a href="#">Read</a>
PRESIDENCY COLLEGE T/H NO.1	5211702	0324800	<a href="#">Read</a>
PRESIDENCY COLLEGE T/H NO.2	4603097	0324790	<a href="#">Read</a>
SALKIA JUTE PRESS O/T	4753069	0652040	<a href="#">Read</a>
SALKIA JUTE PRESS O/T NO-2	4753070	0600057	<a href="#">Read</a>

[DTR READER](#) | [HT CON READER](#) | [LTCT CON READER](#)

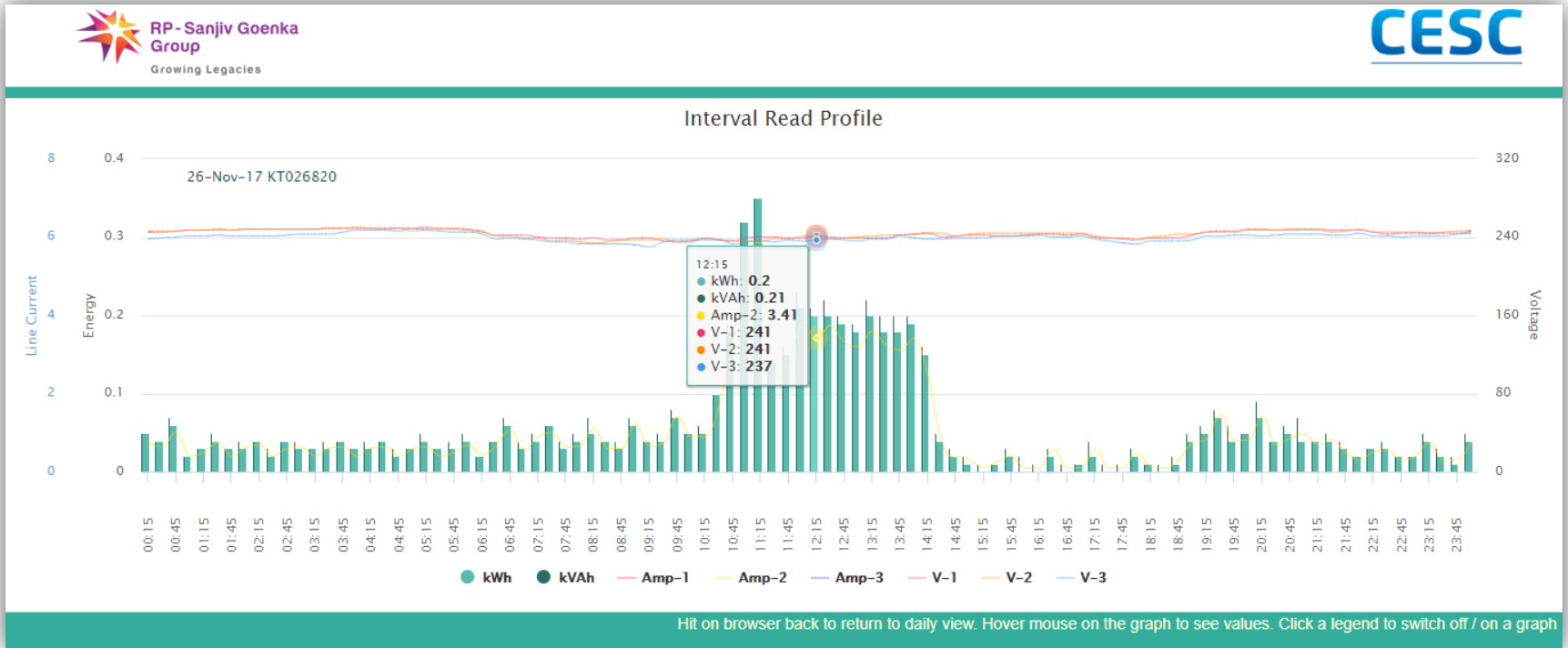
Insta Meter Reader - Google Chrome

itweb:38772/tdamr/reading\_instant\_view.jsp?sname=PRESI...

PRESIDENCY COLLEGE T/H NO.1

Voltage 1	237.340 V
Voltage 2	239.030 V
Voltage 3	237.500 V
Line Current 1	78.430 A
Line Current 2	85.430 A
Line Current 3	69.910 A
Instant KW Load	50.780
Instant Overall PF	0.916 (+)
Meter No.	S5211702 [3P4W]
Reading Date-Time	28-11-2017 11:51:22

# Instant Voltage Read – LT Smart Meter



Thank You